Instruction Manual

MODEL 921-2 84.903 Mb/s
BIT SYNCHRONIZER
SIGNAL CONDITIONER

Y441/TRW

MP MASTER
MA29840

Scientific Atlanta

Instruction Manual

MODEL 921-2 84.903 Mb/s
BIT SYNCHRONIZER
SIGNAL CONDITIONER

Y441/TRW

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Model No.
Serial No.

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TRW COMPONENT MANUAL
MODEL 921-2 84.903 Mb/s BIT SYNCHRONIZER
SIGNAL CONDITIONER

April 1980

SCIENTIFIC-ATLANTA
3845 PLEASANTDALE ROAD
ATLANTA, GEORGIA 30340

NOTICE

CHANGE NOTICES

This manual applies to serial number 002 and up. Serial number 001 does not include a data and clock inhibit function when the input signal is not locked, otherwise the unit is functionally identical. Serial number 001 also does not have a clock inhibit signal between A4 and A3. On A4, U12 is omitted and on A3, pin 7 of U2 is open.

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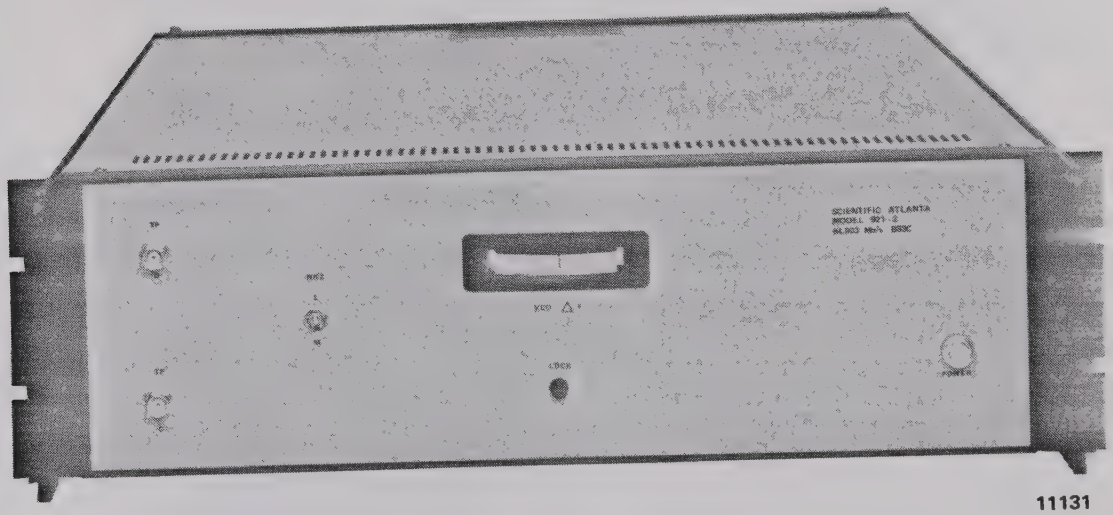


Figure 1-1. Model 921-2 84.903 Bit Synchronizer Signal Conditioner

SECTION 1
INTRODUCTION

1.1 GENERAL DESCRIPTION

This manual describes the Scientific-Atlanta (part number 196315) Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner (BSSC) and its function. It also provides instructions for installation, operation, theory of operation and maintenance with parts list and drawings supplied for logistics and reference purposes. Each essential component of the unit is described with applicable function and maintenance.

1.1.1 Physical Description

The 84.903 Mb/s bit synchronizer signal conditioner components are contained in a standard 19-inch unit enclosure capable of being mounted in a standard equipment rack. See figure 1-1. The front panel contains indicators, test points, a two-position switch and a power indicator switch. The rear panel contains input and output connectors and a mounted cooling fan. See figure 2-2 for illustration of the rear panel components.

1.1.2 Functional Description

The Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner (BSSC) works with the Model 921-3 15.062 Mb/s Bit Synchronizer Signal Conditioner and the Model 921-1 UQPSK Demodulator as a system. The demodulator provides a noisy data stream to the unit at a data rate of 84.903 Mb/s.

The BSSC regenerates clean data from the noisy signal and recovers a data rate clock. Error rate performance is near theoretical limits.

1.2 PURPOSE

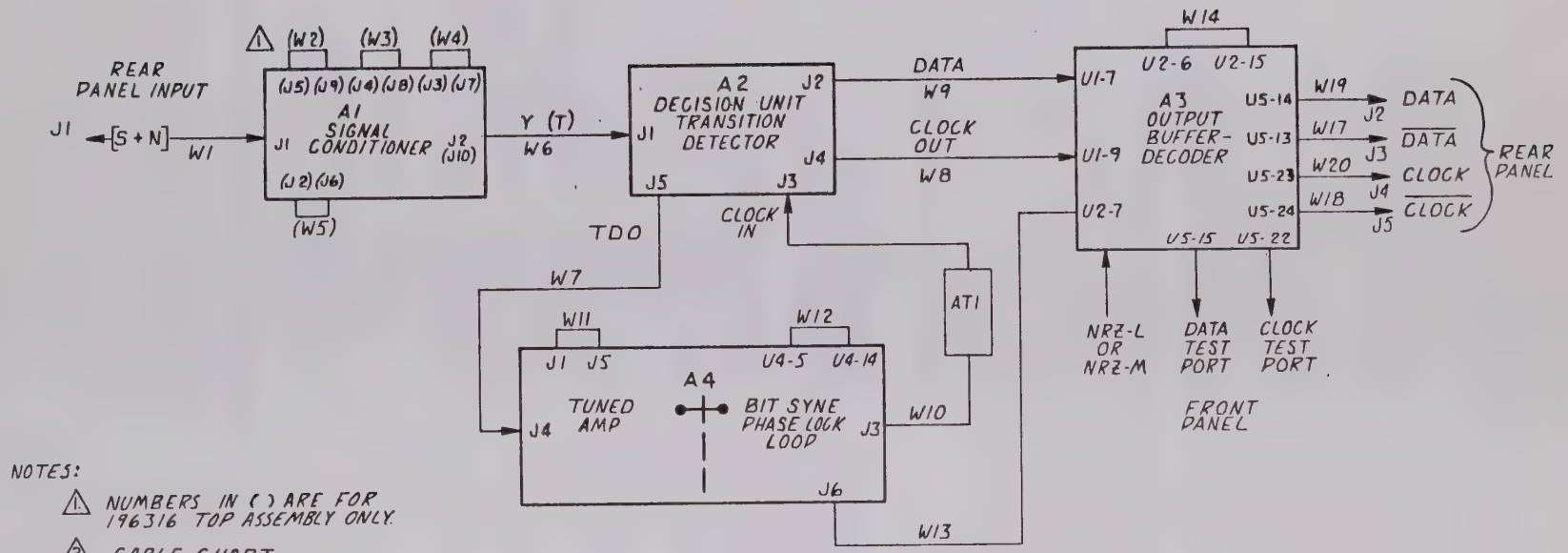
The purpose of the Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner is to regenerate thematic mapper data recovered by the 921-1 demodulator and to provide data and clock signals for further processing.

1.3 TECHNICAL CHARACTERISTICS

Essential primary power and operating characteristics for the Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner are listed in table 1-1.

TABLE 1-1. MODEL 921-2 84.903 MB/S BIT SYNCHRONIZER SIGNAL CONDITIONER

Characteristics	Specification (nominal)
Functional	
Input Impedance	50 ohms
Input Level	600 - 800 mV P-P
Output Impedance	50 ohms
Output Level (clock and data)	
Relationship of clock/data	Negative transition at middle of bit period ± 1n sec
Clock Symmetry	50% nominal ±10%
Input Power	110 V ac, 60 cycles
Internal Power Supply	±15V dc, 500 MA ±5V dc, 3A
Environmental	
Operating	
Temperature	55° to 95°F
Pressure	Sea level to 5000 ft
Shock and vibration	Consistent with rack mounting
Non-Operating-Packing suitable	
Temperature	-45° to +150°F
Humidity	0 to 95 percent
Pressure	Sea level to 15,000 ft



NOTES:

1. NUMBERS IN ( ) ARE FOR 196316 TOP ASSEMBLY ONLY.
2. CABLE CHART.

WIRE NO.	PART NO.
W1-7,10,11	244682
W8,9,13	244681
W12,14	244683
W15-20	244680

Figure 1-2. Model 921-2 84.903 Mb/s
Bit Synchronizer Signal Conditioner Block Diagram

1.4 ASSOCIATED EQUIPMENT

Table 1-2 lists the associated equipment used with the Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner.

TABLE 1-2. ASSOCIATED EQUIPMENT LIST

Component		Part Number
Model 921-1	UQ PSK Demodulator	196314
Model 921-3	15.062 Mb/s Bit Synchronizer Signal Conditioner	196316
Model 921-4	Noise Test and Downconverter	196317

TABLE 1-3. RECOMMENDED TOOLS AND TEST EQUIPMENT REQUIRED BUT NOT SUPPLIED

Unit	Quantity	Model	Manufacturer
Data Generator	2	3762A	Hewlett-Packard
Error Detector	2	3763A	Hewlett-Packard
Power Meter	1	435A	Hewlett-Packard
Spectrum Analyzer	1	141T	Hewlett-Packard
Frequency Counter	1	5345A	Hewlett-Packard
Frequency Synthesizer	1	SI-160	Syntest Inc.
Frequency Synthesizer	1	SI-101	Syntest Inc.
Oscilloscope	1	7903	Tektronics
Oscilloscope	1	SEC502	Tektronics

SECTION 2
INSTALLATION

2.1 GENERAL

The Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner is supplied with provisions for installation in a standard equipment rack. The unit will conform to standard designated by existing conditions and the installing agency as to unit location and type of installation. This section contains procedures and factors to be considered before installing the unit.

2.2 UNPACKING AND INSPECTION

Exercise caution when unpacking the unit. Carefully open each carton and inspect the unit for shipping damage. If a claim for damage is to be made, save the packing material and shipping carton to substantiate the claim. File the claim with the carrier and notify the local Sceintific-Atlanta sales representative immediately. Do not return the unit until shipping instructions have been received from the factory. After all units have been removed from the shipping cartons, check all packing material for small components that may have been wrapped separately. Compare the units received against the packing list. Replace all packing material in the shipping cartons and save the materials for future unit storage or reshipment.

2.3 MOUNTING PROVISIONS

The mounting provisions for the unit are shown in figure 2-1. The unit mounting provisions consist of a mounting channel bracket on each side with four slots provided on the front panel for attachment to the equipment rack.

2.4 INSTALLATION

The unit is installed in the desired equipment rack location by aligning the four panel slots with holes in the rack and inserting the mounting bolts and hardware. After the unit has been installed, all connections with the associated equipment should be completed. Table 2-1 provides the connectors, reference designations and functions. A rear view of the unit is shown in figure 2-2.

TABLE 2-1. REAR CONNECTORS AND COMPONENTS

Connector/Components	Ref. Design.	Function
INPUT Connector, TNC	J1	Input connector for cabling from demodulator
DATA Connector, TNC	J2	Data Output
$\overline{\text{DATA}}$ Connector, TNC	J3	Complementary data output
CLOCK Connector, TNC	J4	Bit rate clock output
$\overline{\text{CLOCK}}$ Connector, TNC	J5	Complementary bit rate clock output
Fuse 2A	F1	2-amp SLO-BLO fuse to protect the power supply from power surges
Filter/Plug 1A 115/120V ac	FL1	To filter out static produced by power input and provide a power receptacle
Fan, 4½ in Boxer	B1	To provide cooling for unit component
Ground	G1	To provide grounding of the unit

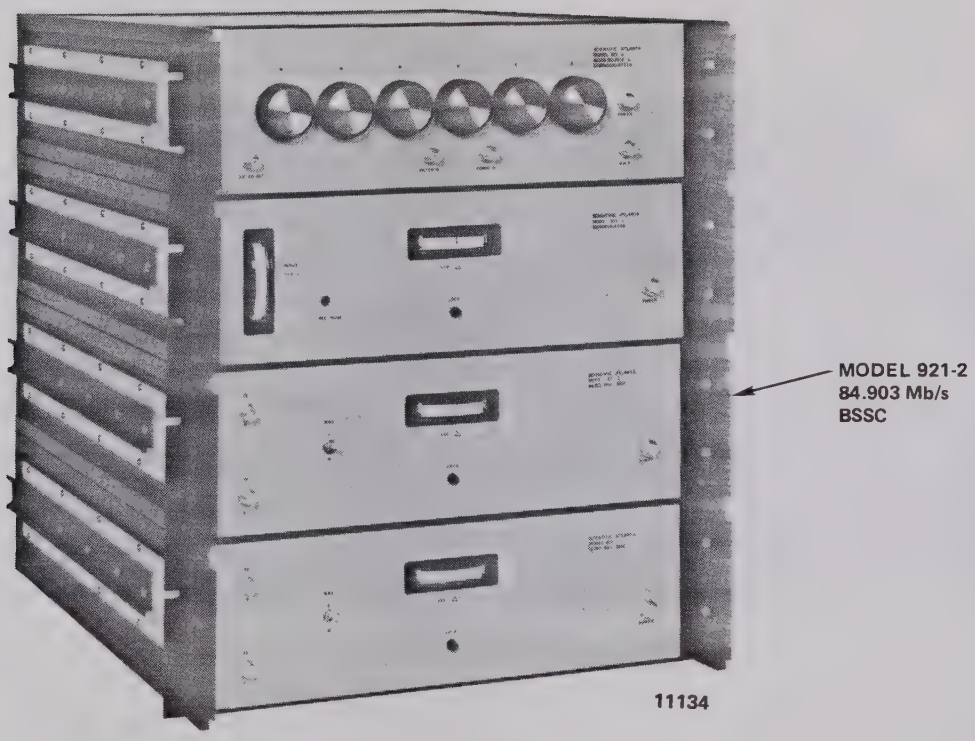


Figure 2-1. Model 921-2 84.903 Mb/s Bit Synchronizer
Signal Conditioner Mounting Provisions

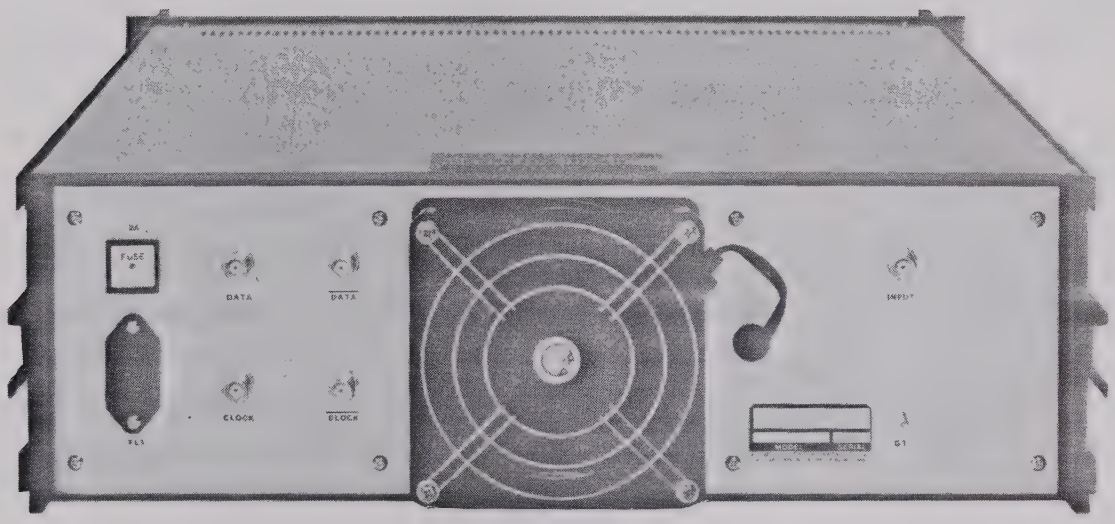


Figure 2-2. Model 921-2 84.903 Mb/s Bit Synchronizer
Signal Conditioner Rear Connections

SECTION 3
OPERATION

3.1 GENERAL

The Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner unit receives and provides an optimum data estimate of the baseband signal-plus-noise (S+N) from the demodulator, and generates a bit rate clock providing differential ECL compatible data and clock outputs. The unit is self-contained and requires no operator intervention except initial selection of output data format (NRZ-L or NRZ-M).

3.2 CONTROLS AND INDICATOR

The unit front panel contains the following indicators; VCO (voltage controlled oscillator) frequency offset meter, phase lock (LED) lamp. A power on/off pushbutton lighted switch, a two-position data format switch, data test point and a bit rate clock test point are also on the panel. Refer to table 3-1 for indicator, control and test point functions.

TABLE 3-1. DETAIL CONTROLS, INDICATORS, AND TEST AND MONITORING POINTS

Controls/Indicators	Ref. Design.	Function
VCO Δf Meter	M1	Indicates input clock frequency offset from the free running VCO frequency
LOCK indicator	DS1	Green LED. On indicates phase lock of clock recovery circuit
Power lamp pushbutton on/off switch	S2	To turn the power on or off in the unit and indicates the status.
NRZ - L or M (switch)	S1	Establishes data output format as either NRZ-L or NRZ-M
Test Point TP/D (data	J6	Data output monitor, 50 ohm
Test Point TP/C	J7	Clock output monitor, 50 ohm

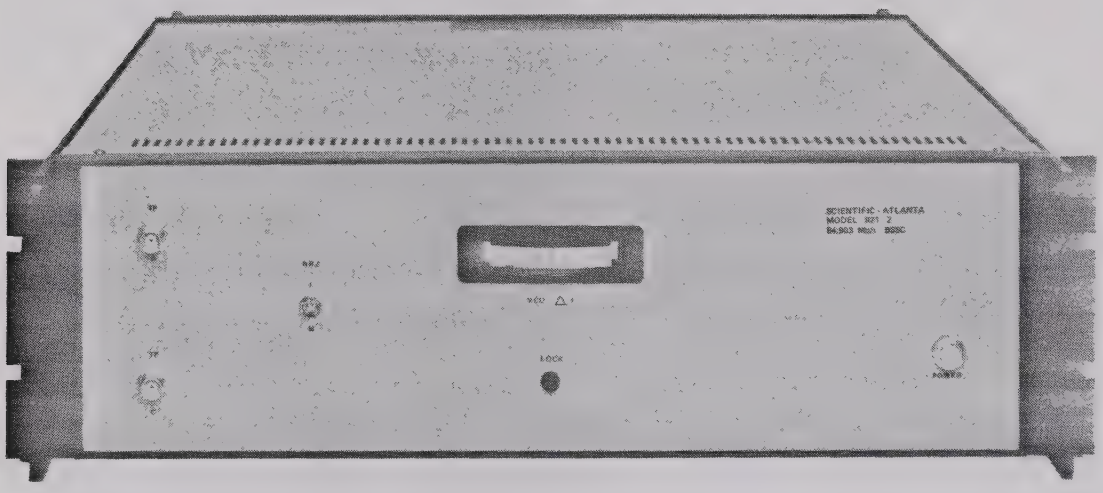


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Figure 3-1. Model 921-2 84.903 Mb/s Bit Synchronizer
Signal Conditioner Controls and Indicators

SECTION 4
THEORY OF OPERATION

4.1 GENERAL

The following sections describe the theory of operation of the Scientific-Atlanta Model 921-2 Bit Synchronizer and Signal Conditioner (BSSC). Paragraph 4.2 provides a description of the unit's function and overall operation, while paragraph 4.3 describes operation of each circuit at a component level.

4.2 OVERALL FUNCTIONAL DESCRIPTION

The Model 921-2 BSSC processes noisy baseband digital signals to produce a noise-free data output and synchronized clock output with a near-theoretical error rate performance.

As shown in figure 4-1, the unit consists of four basic functional units. The input signal plus noise is filtered by the signal conditioner, A1, to maximize the signal-to-noise ratio at the output. Circuitry is also present to provide base line offset correction if needed. The filtered output of the signal conditioner is then operated on by the decision unit, part of A2, to provide an optimum estimate of the state of the input signal. A second function of A2 is the transition detector circuitry which provides a spectral component at the bit rate. A phase-locked loop A4 is locked to this spectral component to regenerate the clock signal from the data. The clock is then fed back to the decision unit to provide the correct timing for estimating the data state. The data and clock signals are then processed by the output buffer/decoder circuit to provide buffered differential data and clock outputs, buffered test ports, and either NRZ-L or NRZ-M data output formats.

Each of the functional units (A1 - A4) is contained on a separate printed circuit board. DC supply voltage is provided from a single self-contained multi-voltage power supply.

4.3 DETAILED FUNCTIONAL DESCRIPTION

The following paragraphs provide a detailed description of the operation of the four functional units shown in figure 4-1.

4.3.1 Signal Conditioner (A1)

The following discussion references figure 7-3, Signal Conditioner Schematic Diagram (196322). The input signal plus noise at J2 is filtered by a two-pole butterworth approximation to a sliding integral matched filter. Amplifiers AR1 - AR3 are ac coupled thin film amplifiers. The output of AR3 is split into two paths. AR5 amplifies one path and drives a mean of peaks detector CR1 - CR4 and U1. The other path is amplified by AR4 and is ac coupled to the output port J2. The output of the mean of peaks detector is dc coupled through R19 and R20 to J2. R20 is adjusted to provide a feed forward dc correction for the offset introduced by the ac coupling. Both input and output ports are nominally 50 ohm impedance.

4.3.2 Decision Unit - Transition Detector (A2)

The output of A1 is routed via coaxial cable to the A2 board, shown schematically in figure 7-5. The input, J1, of A2 is terminated by a 50 ohm resistor and connected to the inputs of two high speed comparators, U1 and U3. U1 provides an ECL compatible output to the D flip-flop U2. The comparison reference voltage, nominally zero volts is set by R21.

Integrated circuits U3, U4, and U5 form a transition detector used for recovering the timing clock from the data. Comparator U3 produces complimentary ECL outputs that are each NORed by U5 with an inverted delayed version of the comparator output. The delay is the two gate delay produced by U4A/U5A and U4B/U5C. The result is a short positive pulse at the output of U5B whenever U3 makes a negative transition, and a similar pulse at the output of U5D whenever U3 makes a positive transition. These two outputs are hardwired ORed to produce a positive pulse at each transition of U3. The output of the transition detector is ac coupled to J5. This output contains a spectral component at the bit rate which is used to synchronize a VCO on board A4.

The oscillator output of A4 is returned to the A2 board at J6 where it is delayed by variable delay line DL1. The output of the delay line is impedance matched by emitter follower Q1 and amplified by thin film amplifiers AR1 and AR2 before being converted to ECL levels by comparator U6. The output of U6 is used to clock flip-flop U2. For optimal error performance delay line DL1 is adjusted to provide clocking of U2 at the middle of each bit period, when the input at J1 has reached its maximum value. The output of U2, the data estimate is provided at J2. A complimentary clock output, with positive transition at mid-bit of the J2 output is ac coupled to J4.

4.3.3 Output Buffer - Decoder (A3)

The data and clock outputs from A2 are routed via matched length coax to A3, shown schematically in figure 7-7. Dual D flip-flop U1 and exclusive OR gate U3 form an NRZ mark decoder. U1 is wired as a two-bit shift register for the data. As the data is clocked through the register, if both bits are the same, then the output of U3 is low; if however a transition has occurred and the data in the shift register is different, then U3 outputs a high, thus decoding NRZ - Mark coding. The NRZ-M decoding is inhibited by placing a high at pin 11 of U2, thus leaving one input to U3 always low. The decoder circuit thus acts only as a one bit delay and provides NRZ-level output.

U2B, U2C, U2D, flip-flop U4, and a fixed-delay line are used to compensate for the delay of the decoder and re-establish the proper clock-to-data timing, a positive clock transition in the middle of the bit period. U2C is also used to inhibit the clock and data outputs if phase lock is lost on board U4.

U5 is a dual differential output driver, providing differential data and clock outputs, along with 50 ohm output test points for both clock and data. Output cable lengths are all matched to provide proper timing.

4.3.4 Tuned Amplifier and Phaselocked Loop A4

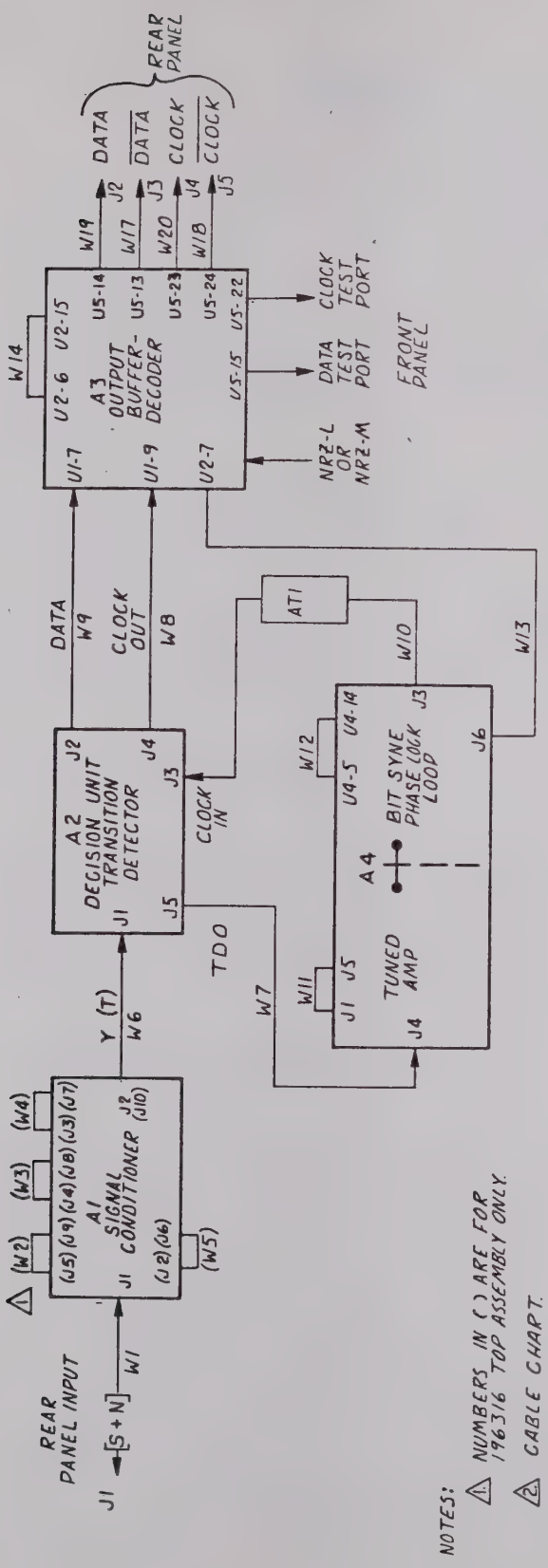
The A4 board shown schematically in figure 7-9 phase locks a voltage controlled oscillator (VCO) to the bit rate spectral component present in

the output of the transition detector on A2. The oscillator output provides timing for the A2 board.

The tuned amplifier is formed, by Q1 - Q3 with input at J4 and output at J5. Inductor L1 and capacitors C31 and C32 form a single resonant circuit at the bit rate, providing both filtering and memory through ringing since transitions are not always present.

The output is jumpered to J1, the input to the phaselocked loop (PLL). High-speed comparator U1 acts as a limiter, maintaining constant phase detector gain with variable input levels. Mixers U2 and U3 serve as phase detectors with U3 operating as the loop error detector and U2 as a lock detector. The error voltage from U3 is integrated by U5 to provide the VCO control voltage. The VCO is formed by U6 with resonant circuit L2, C15, C19 and varactor CR1 controlling the frequency. A front panel meter monitors the control voltage. The output of the VCO is buffered by U4. Delay line W1 provides a 90^{o} delay to provide a quadrature output for the lock detector. Differential clock outputs are provided at J2 and J3. The output of the lock detector is compared to a 100 mV bipolar reference level by U9A and B. When lock is detected, the output of Mixer U2 will be non-zero producing a high level at the output of U10A. Lock detection turns on LED CR4 and provides a low output at Pin 2 of the TTL to ECL converter U12. This signal is cabled to the A3 board to inhibit the data and clock outputs when lock is lost.

Integrated circuit U8, PRAM U11 and integrator U5 form a search oscillator to aid PLL acquisition. When the loop is not locked U10A output is low, allowing the PRAM to output either a positive or negative current through R23 to the summing junction of U5. The polarity of the current is set by the state of the RS flip-flop format by U8C and U8D. U5 integrates until one of the comparators U8A or U8B is tripped by its output exceeding $\pm$3V trip points. This causes the flip-flop to change states reversing the integration direction. The result is a triangle waveform at the VCO input causing the VCO to sweep through its limits. When lock is detected, U10A goes high producing a zero current output from the PRAM, disabling the search feature.



NOTES:

1. NUMBERS IN ( ) ARE FOR 196316 TOP ASSEMBLY ONLY.
2. CABLE CHART.

WIRE NO	PART NO
W1-7,10,11	244682
W8,9,13	244681
W12,14	244683
W15-20	244680

196356

Figure 4-1. Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner Block Diagram

SECTION 5
MAINTENANCE

5.1 GENERAL

This section provides instructions and information pertaining to preventive and corrective maintenance of Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner.

5.1.1 Preventive Maintenance Definition

Preventive maintenance includes scheduled inspection, routine test, cleaning and lubrication and minor repairs and adjustments to aid in preventing malfunctions and improving reliability.

5.1.2 Corrective Maintenance Definition

Corrective maintenance includes troubleshooting which involves symptom analysis, system and circuit level isolation, and repair and replacement of parts to restore the unit to normal operation.

5.2 PREVENTIVE MAINTENANCE

Preventive maintenance includes scheduled inspection, routine tests, cleaning and lubrication, and minor repairs and adjustments.

5.2.1 Inspection and Routine Tests

The unit should be inspected periodically using the following procedure.

a. Disconnect the unit from the power source.

b. Remove the unit from the equipment rack.

c. Remove cover.

d. Inspect all wiring and cables for frayed, loose or burned wires.

e. Check cable connections making sure the plugs are free from corrosion and are properly secured.

f. Check all components for evidence of overheating, breakage, vibration damage, corrosion, or loose connection.

g. Inspect all board components; i.e., capacitors, resistors, transformers, and transistors for leaks, distortions, and other defects.

h. Any defects found during inspection shall be corrected immediately.

Routine tests should be conducted during initial turn-on for proper required outputs. If the outputs are above or below set tolerances, check components for damage or loose connections.

5.2.2 Cleaning

The unit should be cleaned as often as operating conditions will permit. Accumulation of dust in the unit can cause overheating and component breakdown. Dust on the components provides an electrical conduction path and also acts as an insulation blanket and prevents efficient heat dissipation. The following procedure should be used when cleaning the unit and its components.

a. Using a clean, lint-free cloth, lightly moistened with an approved cleaning solvent, remove foreign material from the unit.

b. Use a small paint brush to remove dust on or around the front panel controls and rear receptacles.

c. Clean the electrical contacts of the connectors with an approved spray type contact cleaner.

c. Clean the internal receptacle and circuit boards with a hand controlled dry jet (not more than 15 lbf/in^2), and a clean lint-free cloth lightly moistened with an approved cleaning solvent. Wipe dry with a lint-free cloth.

5.3 CORRECTIVE MAINTENANCE

The corrective maintenance procedures provided in the following paragraphs include troubleshooting and alignment. The proven circuit design, the use of highly reliable components and recommended preventive maintenance should reduce the possibility of failure. However, if one of the components of the unit should fail, take the following necessary action.

a. Determine that the failure exists in the component. Eliminate the possibility of external equipment causing difficulty.

b. Determine the general, then the specific nature and location of the failure by electrical test and referring to table 5-1.

c. The particular circuit and its location in the unit should be apparent. If the particular circuit is not clearly defined, refer to the circuit description in section 4.

d. Pinpoint and replace the faulty part. Refer to section 7 for the part location and to section 6 for the part number to insure that the correct part has been used.

e. Apply power and observe the component for signs of further failure.

f. Thoroughly test the unit operation associated with the repaired circuit.

5.4 ALIGNMENT PROCEDURE

5.4.1 General

For alignment the unit requires the equipment listed in tables 1-2 and 1-3. The noise test set should be calibrated in accordance with the procedures listed for the 921-1 demodulator. The output of the demodulator is cabled to the 921-3 and error detector connected to the data and clock outputs of the unit.

5.4.2 Signal Conditioner A1

With the data generator producing a 16 bit pattern, connect an oscilloscope to J2 of A1 and adjust L1 and C3 so that the positive or negative swing of a single bit pulse just reaches the full value obtained with multiple bit pulses. Adjust R20 to minimize dc offset when changing bit patterns. Reconnect J2.

5.4.3 Tuned Amplifier and Phaselock Lock Loop A4

Connect an oscilloscope to J5 on A4. Adjust L1 for maximum output. Replace the cable to J5.

Adjust L2 until the phase lock lamp lights and the VCO Δf meter reads zero.

5.4.4 Decision Unit (A2)

Adjust R21 for zero volts at the wiper of R21. Connect, using a 3 dB coupler, a 50 ohm oscilloscope input to J1; connect the other oscilloscope input to J3 using a cable of equal length. Display both traces and adjust delay line DL1 so that the clock signal J3 makes a positive transition $\sim$.1 μ sec before the signal at J1 reaches its maximum value. If this adjustment cannot be made, switch the cable connecting J6 to A4 from A4J2 to A4J3 or vica versa and readjust.

5.4.5 Error Rate Optimization

Set the error rate meter for REP mode and the period for 10^6. Adjust the test set noise level for an error count of between 10 - 100. Slight adjustments of R21 and DL1 on the AZ board and L1 and C3 on A1 may be needed to minimize the error count. Remember that errors are random and their count will fluctuate. Make all adjustments slowly and wait for several count periods before making another adjustment. Upon completion of this step the unit is fully aligned.

TABLE 5-1. TROUBLESHOOTING CHART

Symptom	Probable Cause	Remedy
No Data	Power Supply failure	Check supply voltages, repair
No Clock		
No Phase Lock		
VCO Not Searching	A4 Board Failure	Check for correct operation, repair
	---	
No Data	No Input	Check cables
No Clock		
No Phase Lock	A1, A2, or A4 board failure	Test for correct operation, repair
VCO Searching		

Phase Lock	A2, A3, A4 board failure	Test for correct operation, repair
No Data		
No Clock		

Phase Lock	A4 board failure	Test for correct operation, repair
Data		
No Clock		

TABLE 5-1. TROUBLESHOOTING CHART - continued

Symptom	Probable Cause	Remedy
Phase Lock Clock No data	A2, A4 board failure	Test for correct operation, repair

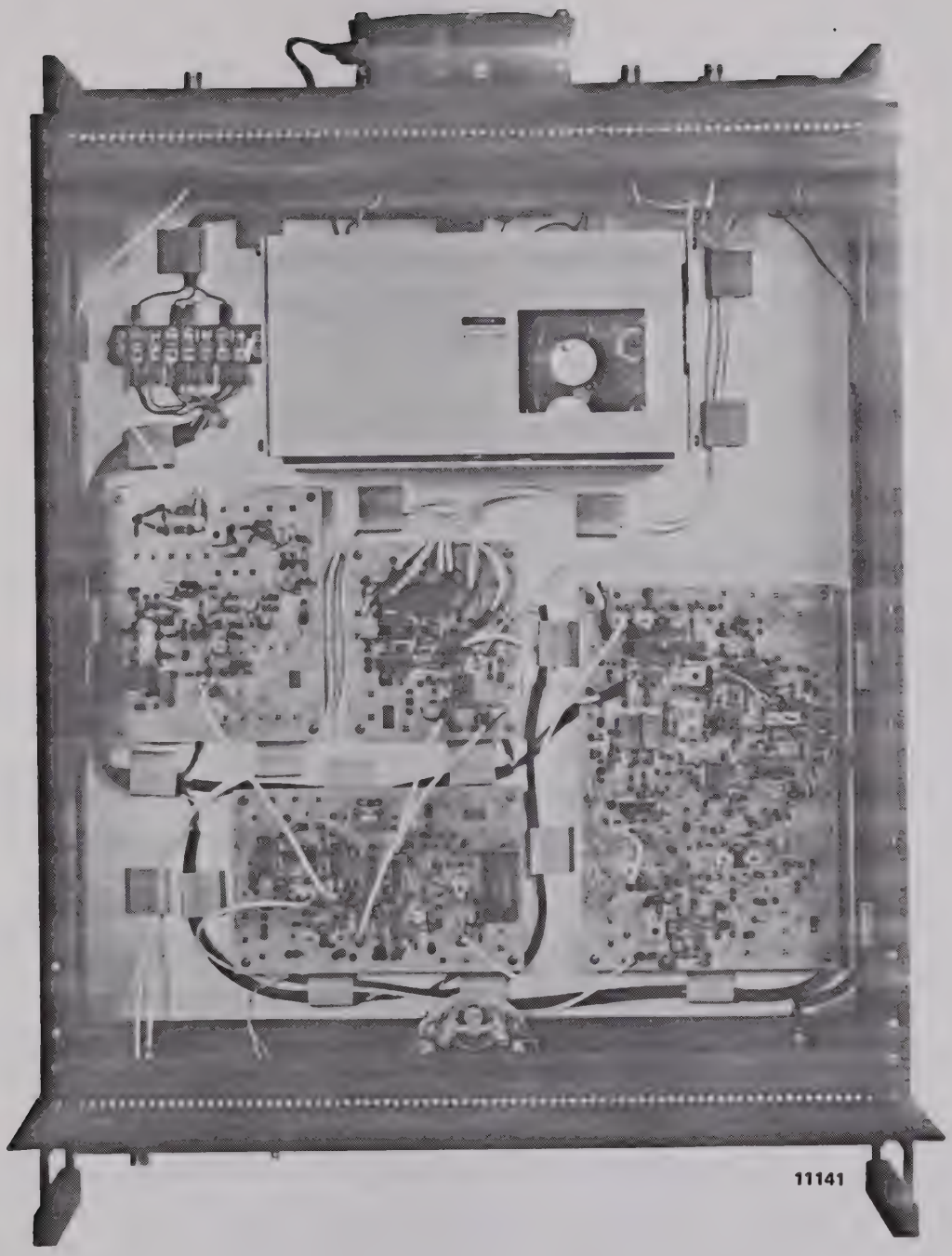


Figure 5-1. Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner Interior

SECTION 6
REPLACEMENT PARTS

6.1 GENERAL

The parts list in this section contains a description of all replaceable components. For information on parts not listed here, consult the factory or your local Scientific-Atlanta representative.

6.2 EXPLANATION OF COLUMN HEADINGS

ITEM:	This is the component designation or find number that appears on the schematic diagram or assembly drawing for that unit.
QUANTITY REQUIRED:	Number of items required for the component.
NOMENCLATURE OR DESCRIPTION:	A brief electrical or mechanical description is given in this column.
MATERIAL SPEC AND SIZE OR COMPONENT VALUE:	Self-explanatory.
IDENTIFYING OR PART NUMBER:	Manufacturer's part number. No part number indicates the part is available from Scientific-Atlanta.
CODE IDENTIFICATION:	Federal Supply Code for manufacturer's codes is entered here. The code numbers are from the Federal Supply Code for Manufacturer's Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) effective on the publication date of this manual.

PARTS LIST

BIT SYNCHRONIZER - SIGNAL CONDITIONER 84.903 Mb/s
ASSEMBLY PART NUMBER 196315

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Ref	0		Assembly Drawing		196315	
Ref	0		Block Diagram		196356	
1	1 ea	193285	Chassis Assembly			
2	1 ea	196302	Front Panel			
3	1 ea	196301	Rear Panel			
4	4 ea	203677	Bracket, Panel Mounting			
5	1 ea	198619	Plate, Bottom Mounting			
6	10 ea	078390	SCR, Dress 4-40 x ½			
7	32 ea	072317	SCR, P.H. 4-40 x ¼			
8	4 ea	072334	SCR, P.H. 4-40 x 5/8			
9	12 ea	072350	SCR, P.H. 6-32 x ¼			
10	8 ea	072378	SCR, P.H. 6-32 x 3/4			
11	10 ea	072389	SCR, Flt. HD. 8-32 x ¼			
12	22 ea	083732	Washer, Flat #4			
13	22 ea	076779	Washer, Lock, Spring #4			
14	16 ea	076075	Washer, Lock, Internal Star #4			
15	20 ea	083264	Washer, Flat #6			
16	16 ea	073268	Washer, Lock #6 Spring			
17	22 ea	071494	Nut #4-40			
18	8 ea	075446	Nut #6-32			
19	10 ea	071500	Nut, #8-32			
20	16 ea	075873	Spacer 4-40 x 3/4			
21	4 ea	072859	Spacer 6-32 x ½			
22	16 ea	077322	SCR Taptite 4-40 x ¼			
23	1 ea	077195	Power,Cord, Fan			
24	1 ea	088431	Finger Guard			
25	1 ea	083499	Grommet, Rubber			

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PARTS LIST

BIT SYNCHRONIZER - SIGNAL CONDITIONER 84.903 Mb/s - continued
ASSEMBLY PART NUMBER 196315

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
26	1 ea	083214	Cover, Fuse, Indicating			
27	3 ea	082805	Clip, Jumper			
28	1 ea	132438	Lable - Caution			
29	1 ea	132439	Lable - Caution			
30	1 ea	198223	Lable Model - S/N			
31	A/R	087239	Cable Clamp, Flat			
32	1 ea	208239	Cover, Protective, Power Supply			
33	12 ea	078679	Spade Lugs			
34	A/R	073045	Cable Ties			
35	A/R	077937	Tubing, Heat Shrink			
36	A/R	075931	Tubing, Vinyl BLK			
37	A/R	073212	Tubing, Vinyl BLK			
38	A/R	073207	Tubing, Vinyl BLK			
39	A/R	073387	Wire #22 Red			
40	A/R	073392	Wire #22, Violet			
41	A/R	073385	Wire #22, Black			
42	A/R	073403	Wire #22, White/Violet			
43	A/R	073355	Wire #18, Gray			
44	A/R	073365	Wire #18, White/Gray			
45	A/R	073317	Wire #20 Buss			
AT1	1 ea		Attenuator 5 dB		3300-5	93459

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PARTS LIST

BIT SYNCHRONIZER - SIGNAL CONDITIONER 84.903 Mb/s - continued

ASSEMBLY PART NUMBER 196315

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
A1	1 ea	196357	PWB Assy., Signal Conditioner			
A2	1 ea	196323	PWB Assy., Decision Unit-Transition Det.			
A3	1 ea	196326	PWB Assy., Output Buffer-Decoder			
A4	1 ea	196329	PWB Assy., Tuned Amp-Phaselock Loop			
B1	1 ea	074200	Fan			
DS1	1 ea	086973	LED, Green			
FL1	1 ea	088436	Filter-Plug, A.C.			
F1	1 ea	071226	Fuse, 2A Slo-Blo			
J1-7	7 ea	086211	Conn., Type TNC Bulkhead			
M1	1 ea		Meter, Horizontal		E-25H-50-0-50DC μa	
PS1	1 ea	088450	Power Supply		ET401-11	
S1	1 ea	086981	Switch, Toggle			
S2	1 ea	080116	Switch, Pushbutton			
TB1	1 ea	085622	Terminal Board			
XF1	1 ea	083213	Fuse Holder			

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PARTS LIST

SIGNAL CONDITIONER 84.903 Mb/s

ASSEMBLY PART NUMBER 196357

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Ref	0		Assembly Drawing		196357	
Ref	0		Schematic		196359	
1	1 ea	196358	PWB			
1	A/R	076627	Solder	Per QQ-S-571E		
AR1-5	5 ea		Amplifier, General Purpose		AH-364	
CR1-4	4 ea	087317	Diode, Batch Matched		HP 5082-2826	28480
C1	1 ea		Capacitor, Chip	50V Solder Term 30 pf	ATC100B300J500	29990
C2	1 ea		Capacitor, Chip	50V Solder Term 68 pf	ATC100B680J500	29990
C3	1 ea		Capacitor, Variable	0-20 pf	5501	91293
C4-19	21 ea	035654	Capacitor, Solid Tantalum	25V 10% 10 mf		
C25-29	---	035654	Capacitor, Solid Tantalum	25V 10% 10 mf		
C20	1 ea	082969	Capacitor, Dipped Silver Mica	500V 1% 1000 pf		
C21,30	2 ea	080139	Capacitor, Ceramic Mono.	50V -20% to +80% .1 mf		
C22,31	2 ea	078806	Capacitor, Dipped Silver Mica	500V 1% 200 pf		
C23,24	2 ea	083258	Capacitor, Chip	50V .1 mf		
E1-9	9 ea	081765	Core Bead, Ferrite	.138X.037X.150L BLU		
J1-2	2 ea	087672	Conn., Female SMA	P.C. Mount, Straight	142-0298-001	74790
L1	1 ea	086140	Inductor, Variable	.18 μh	Coil-Craft Inc. Bronxville, N.Y.	
R1-13	13 ea	075587	Resistor, Carbon Composition	¼w 5% 51 ohm	RCR07G510JS	
R14,26	2 ea	075651	Resistor, Carbon Composition	¼w 5% 2 K ohm	RCR07G202JS	
R15,16	2 ea	081735	Resistor, Carbon Composition	¼w 5% 36 ohm	RCR07G360JS	
R17,18	2 ea	071917	Resistor, Carbon Composition	¼w 5% 300 ohm	RCR07G301JS	

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PARTS LIST

SIGNAL CONDITIONER 84.903 Mb/s - continued

ASSEMBLY PART NUMBER 196357

ITEM OR FIND NO.	QTY REQD.	SA STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
R19	1 ea	081732	Resistor, Carbon Composition	¼w 5% 510 ohm	RCR07G511JS	
R20	1 ea	076956	Resistor, Variable, 15T	3/4w 1 K ohm	3009P-1-102	
R21,27	2 ea	078931	Resistor, Metal Film	¼w 1% 4.99 K ohm	RN55C4991F	
R22,28	2 ea	074727	Resistor, Carbon Composition	¼w 5% 10 K ohm	RCR07G103JS	
R23	1 ea	082448	Resistor, Carbon Composition	¼w 5% 130 K ohm	RCR07G134JS	
R24	1 ea	083910	Resistor, Metal Film	¼w 1% 5.1 K ohm	RN55C5101F	
R25	1 ea	080847	Resistor, Carbon Composition	¼w 5% 62 ohm	RCR07G620JS	
U1	1 ea	087664	I.C. Op Amp 8L-DIP	75°C Comp. HiSlew	HA3-2517-5	

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PARTS LIST

DECISION UNIT - TRANSITION DETECTOR

ASSEMBLY PART NUMBER 196323

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
REF	0		Assembly Drawing		196323	
REF	0		Schematic		196325	
1	1 ea	196324	PWB			
2	A/R	076626	Solder	Per QQ-S-571E		
3	2 ea	072317	SCR, 4-40 X 1/4 P.H., SST			
4	2 ea	071494	Nut, 4-40 SST			
5	2 ea	076779	Washer, Split Lock			
AR 1,2	2 ea	203286	Amplifier, Gen. Purpose		GPD302	
AT 1	1 ea	088623	Termination, SMA Male	50 ohm		
C1, 2	17 ea	080139	Capacitor, Ceramic Mono.	50V -20% to +80% .1 mf		
C4-8	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% .1 mf		
C11-20	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% .1 mf		
C3	0		Not Used			
C9	1 ea	076719	Capacitor, Solid Tantalum	35V 10% 1 mf		
C10	1 ea	03564	Capacitor, Solid Tantalum	25V 10% 10 mf		
DL 1	1 ea		Delay Line, Variable		V1570-1	14948
E1-16	16 ea	081765	Core Bead, Ferrite	11 .138X.037X.150BLU		
J1-6	6 ea	087672	Conn., SMA Female	P.C. Mount Straight	142-0298-001	74970
Q1	1 ea	077147	Transistor		2N3947	
R1,20,	3 ea	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R33	---	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR70G102JS	
R2,7	7 ea	075587	Resistor, Carbon Composition	¼w 5% 51 ohm	RCR07G510JS	

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PARTS LIST

LIMITING AMPLIFIER
ASSEMBLY PART NUMBER 196344

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Ref	0		Assembly Drawing		196344	
Ref	0		Schematic		196346	
1	1	196345	PWB			
2	A/R	076627	Solder	Per QQ-S-571E		
AR1	1 ea	089341	Amplifier, Gen. Purpose		GPD1002	24539
AR2,3	3 ea	089342	Amplifier, Gen. Purpose		GPD1003	24539
5	--	089342	Amplifier, Gen. Purpose		GPD1003	24539
AR4	1 ea		Amplifier, Limiting	TO-8U	UTL1001	24539
C1-6	6 ea	083258	Capacitor, Chip	50V .1 mf		
E1-5	5 ea	081765	Core Bead, Ferrite	11 .138X.037X.150L BLU		
J1-2	2 ea		Conn., SMA, Female	P.C. Mount Straight	142-0298-001	74790

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PARTS LIST

BSSC OUTPUT CIRCUIT

ASSEMBLY PART NUMBER 196326

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Ref	0		Assembly Drawing		196326	
Ref	0		Schematic		196328	
1	1 ea	196327	PWB			
2	A/R	07662 7	Solder	Per QQ-S-571E		
CR1	1 ea	071122	Diode		IN914	
C1-4	4 ea	083258	Capacitor, Chip	50V .1 mf		
E1-9	9 ea	081765	Core Bead, Ferrite	.138X.037X.150 BLU		
R1,7,12	4 ea	071879	Resistor, Carbon Composition	¼w 5% 82 ohms	RCR07G820JS	
R29	---	071879	Resistor, Carbon Composition	¼w 5% 82 ohms	RCR07G820JS	
R2,8,13	4 ea	082448	Resistor, Carbon Composition	¼w 5% 130 ohms	RCR07G131JS	
R28	---	082448	Resistor, Carbon Composition	¼w 5% 130 ohms	RCR07G131JS	
R3-7,9	8 ea	074696	Resistor, Carbon Composition	¼w 5% 470 ohms	RCR07G471JS	
R10,14,15	---	074696	Resistor, Carbon Composition	¼w 5% 470 ohms	RCR07G471JS	
R11	1 ea	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R16,19	4 ea	074693	Resistor, Carbon Composition	¼w 5% 390 ohm	RCR07G391JS	
R22,25	---	074693	Resistor, Carbon Composition	¼w 5% 390 ohm	RCR07G391JS	
R17,20	4 ea	081999	Resistor, Carbon Composition	¼w 5% 240 ohm	RCR07G241JS	
R23,26	---	081999	Resistor, Carbon Composition	¼w 5% 240 ohm	RCR07G241JS	
R18,21	4 ea	080847	Resistor, Carbon Composition	¼w 5% 62 ohm	RCR07G620JS	
R24,27	---	080847	Resistor, Carbon Composition	¼w 5% 62 ohm	RCR07G620JS	
U1	1 ea		I.C.		MC10231L	04713
U2	1 ea	084658	I.C.		MC10102P	
U3	1 ea		I.C.		MC10107P	04713
U4	1 ea	088402	I.C.		F11C06DC	
U5	1 ea		I.C.		F100112DC	7263

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PARTS LIST

PHASELOCK LOOP AND TUNED AMPLIFIER, 84.903 Mb/s

ASSEMBLY PART NUMBER 196329

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Ref	0		Assembly Drawing		196329	
Ref	0		Schematic		196332	
1	1 ea.	196331A	PWB			
2	A/R	076627	Solder	Per QQ-S-571		
CR1	1 ea.		Diode, Varactor		MV1622	04713
CR2,3	2 ea.	071122	Diode		1N914	
C1-6	43 ea	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C8-11	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C14,15	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C18,20,	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C21,25-	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C28,30,	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C33-35	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C37-56	--	080139	Capacitor, Ceramic Mono.	50V -20% to +80% 0.1µf		
C7,16,23	3ea.	077920	Capacitor, Ceramic Mono.	50V 20% 1µf		
C12,17	2 ea.	078819	Capacitor, Dipped Silver Mica	1% 470pf		
C13	1 ea.	081210	Capacitor, Ceramic Mono.	.01µf		
C19	1 ea.	077655	Capacitor, Dipped Silver Mica	500V 5% 20pf		
C22,24	2 ea.	035654	Capacitor, Solid Tantalum	25V 10% 10µf		
C29	1 ea.	077364	Capacitor, Dipped Silver Mica	500V 5% 12pf		
C31	0		Not Used			
C32	1 ea.	070492	Capacitor, Dipped Silver Mica	500V 5% 33pf		
C36	1 ea.	073492	Capacitor, Dipped Silver Mica	500V 5% 15pf		
E1-44	44 ea.	081765	Core Bead, Ferrite	11 .138X.037X.150L BLU		
J1-6	6 ea.	087672	Conn., SMA, Female	P.C. Mount, Straight	142-0298-001	74790
L1,2	2 ea.	087621	Inductor, Variable	±10% .10 mf		

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PARTS LIST

PHASELOCK LOOP AND TUNED AMPLIFIER, 84.903 Mb/s - continued

ASSEMBLY PART NUMBER 196329

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
Q1,3	2 ea.	077147	Transistor		2N3947	
Q2	1 ea.	077148	Transistor		2N3251	
R1,2,	4 ea.	075587	Resistor, Carbon Composition	¼w 5% 51 ohm	RCR07G510JS	
R38,40	--	075587	Resistor, Carbon Composition	¼w 5% 51 ohm	RCR07G510JS	
R3,4,14	6 ea.	074693	Resistor, Carbon Composition	¼w 5% 390 ohm	RCR07G391JS	
R15,18,	--	074693	Resistor, Carbon Composition	¼w 5% 390 ohm	RCR07G391JS	
R20	--	074693	Resistor, Carbon Composition	¼w 5% 390 ohm	RCR07G391JS	
R5,6	8 ea.	081854	Resistor, Carbon Composition	¼w 5% 43 ohm	RCR07G430JS	
R12,13	--	081854	Resistor, Carbon Composition	¼w 5% 43 ohm	RCR07G430JS	
R19,21	--	081854	Resistor, Carbon Composition	¼w 5% 43 ohm	RCR07G430JS	
R36,43	--	081854	Resistor, Carbon Composition	¼w 5% 43 ohm	RCR07G430JS	
R31,65	8 ea.	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R46,47	--	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R51,56	--	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R57,61	--	074702	Resistor, Carbon Composition	¼w 5% 1 K ohm	RCR07G102JS	
R9,8	2 ea.	081996	Resistor, Carbon Composition	¼w 5% 56 ohm	RCR07G560JS	
R10,11	4 ea.	075651	Resistor, Carbon Composition	¼w 5% 2 K ohm	RCR07G202JS	
R27,50	--	075651	Resistor, Carbon Composition	¼w 5% 2 K ohm	RCR07G202JS	
R16	1 ea.	082448	Resistor, Carbon Composition	¼w 5% 130 ohm	RCR07G131JS	
R17	1 ea.	075597	Resistor, Carbon Composition	¼w 5% 82 ohm	RCR07G820JS	
R22	1 ea.	075650	Resistor, Carbon Composition	¼w 5% 1.8 K ohm	RCR07G182JS	
R23	1 ea.	084085	Resistor, Metal Film	¼w 1% 16.5 K ohm	RN55C1652F	
R24	1 ea.	081733	Resistor, Carbon Composition	¼w 5% 750 ohm	RCR07G751JS	
R25	1 ea.	078927	Resistor, Metal Film	¼w 1% 1.65 K ohm	RN55C1651F	
R26	1 ea.	077672	Resistor, Carbon Composition	¼w 5% 33 K ohm	RCR07G333JS	
R28	1 ea.	074696	Resistor, Carbon Composition	¼w 5% 470 ohm	RCR07G470JS	
R29	1 ea.	081732	Resistor, Carbon Composition	¼w 5% 510 ohm	RCR07G511JS	
R30,60	5 ea.	081061	Resistor, Carbon Composition	¼w 5% 200 ohm	RCR07G201JS	
R63,52	--	081061	Resistor, Carbon Composition	¼w 5% 200 ohm	RCR07G201JS	
R54	--	081061	Resistor, Carbon Composition	¼w 5% 200 ohm	RCR07G201JS	

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PARTS LIST

PHASELOCK LOOP AND TUNED AMPLIFIER, 84.903 Mb/s - continued

ASSEMBLY PART NUMBER 196329

ITEM OR FIND NO.	QTY REQD.	S-A STOCK NO.	NOMENCLATURE OR DESCRIPTION	MATL SPEC AND SIZE OR COMPONENT VALUE	IDENTIFYING OR PART NO.	CODE IDENT
R32,33,	3 ea.	071901	Resistor, Carbon Composition	¼w 5% 180 ohm	RCR07G181JS	
R64	--	071901	Resistor, Carbon Composition	¼w 5% 180 ohm	RCR07G181JS	
R35,7	2 ea.	074700	Resistor, Carbon Composition	¼w 5% 820 ohm	RCR07G821JS	
R34	1 ea.	082651	Resistor, Carbon Composition	¼w 5% 910 ohm	RCR07G911JS	
R37,41,	3 ea.	074706	Resistor, Carbon Composition	¼w 5% 1.5 K ohm	RCR07G152JS	
R42	--	074706	Resistor, Carbon Composition	¼w 5% 1.5 K ohm	RCR07G152JS	
R39	1 ea.	074722	Resistor, Carbon Composition	¼w 5% 4.7 K ohm	RCR07G472JS	
R44,48	2 ea.	074727	Resistor, Carbon Composition	¼w 5% 10 K ohm	RCR07G103JS	
R45,49	2 ea.	078938	Resistor, Carbon Composition	¼w 5% 68 ohm	RCR07G680JS	
R53,55	4 ea.	074711	Resistor, Carbon Composition	¼w 5% 2.7 K ohm	RCR07G272JS	
R59,62	--	074711	Resistor, Carbon Composition	¼w 5% 2.7 K ohm	RCR07G272JS	
R58	1 ea.	074679	Resistor, Carbon Composition	¼w 5% 150 ohm	RCR07G151JS	
U1	1 ea.		I.C.		AM685DL	34335
U2,3	2 ea.		Mixer, Double-Balanced		SRA-1	15542
U4	1 ea.		I.C.		MC10103L	04713
U5	1 ea.	087664	I.C		HA3-2517-1	
U6	1 ea.	088401	I.C.		MC1648L	
U7	1 ea.	084724	I.C.		MA78MGC	
U8,9	2 ea.	087698	I.C.		NE521F	
U10	1 ea.	087694	I.C.		SN74S140J	
U11	1 ea.	087665	I.C.		HA1-2405-5	
U12	1 ea		I.C.		MC10124P	04713

SA433-871

SECTION 7
DRAWINGS AND SCHEMATICS

7.1 GENERAL

The drawings and schematics for the Model 921-2, 84.903 Mb/s bit synchronizer signal conditioner are in this section.

Figure	Title	S-A Drawing No.	Page
7-1	Model 921-2 84.903 Mb/s Bit Synchronizer Signal Conditioner Assembly	196315	7-3
7-2	Signal Conditioner PWB Assembly (A1) (sheets 1 of 2, 2 of 2)	196357	7-5
7-3	Signal Conditioner Schematic Diagram	196359	7-9
7-4	Decision Unit-Transition Detector PWB Assembly (A2)	196323	7-11
7-5	Decision Unit-Transition Detector Schematic Diagram	196325	7-13
7-6	Output Buffer-Decoder PWB Assembly (A3)	196326	7-15
7-7	Output Buffer-Decoder Schematic Diagram	196328	7-17
7-8	Tuned Amp-Phaselock Loop PWB Assembly (A4)	196329	7-19
7-9	Tuned Amp-Phaselock Loop Schematic Diagram (sheets 1 of 2, 2 of 2)	196332	7-21

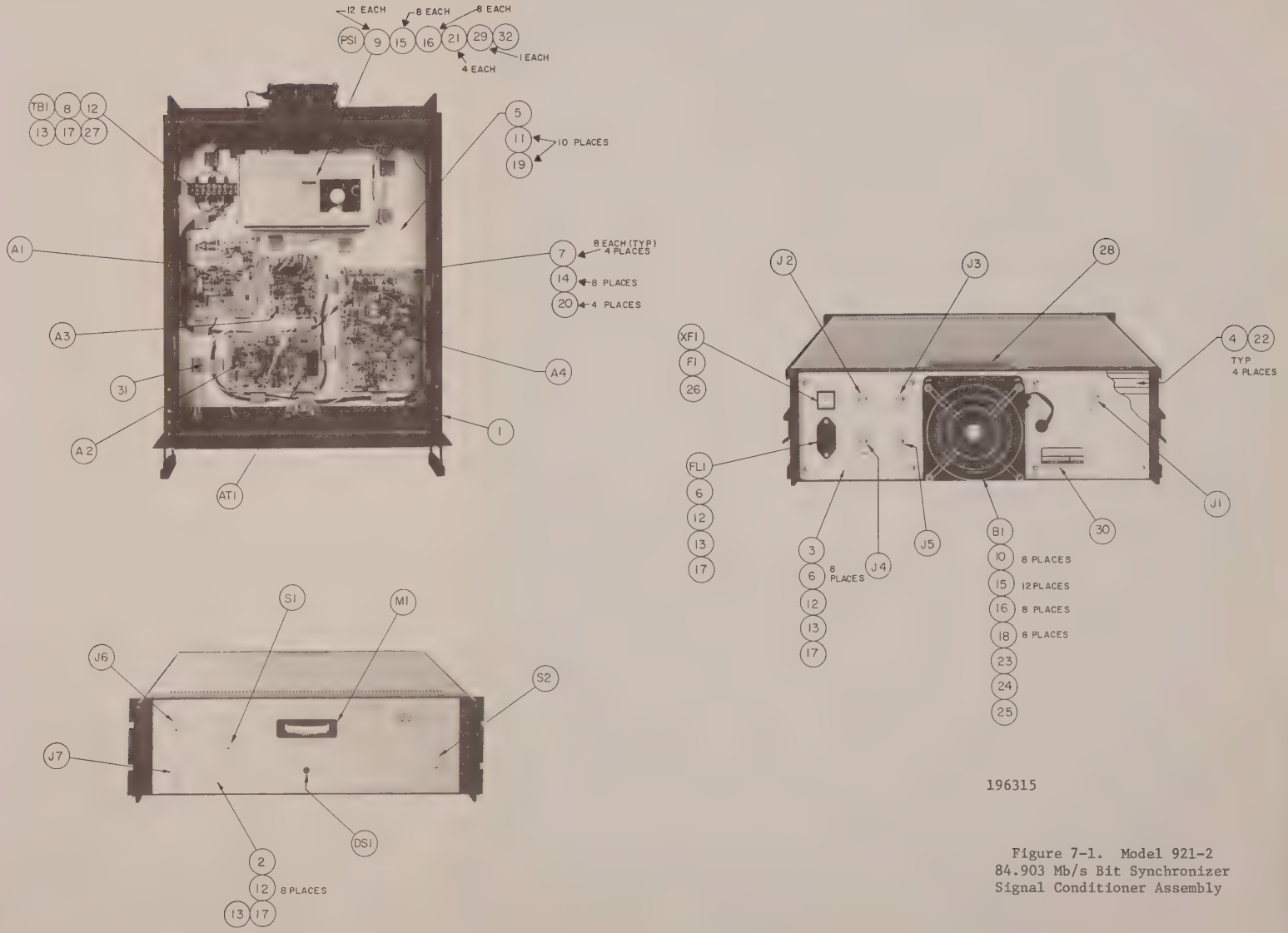
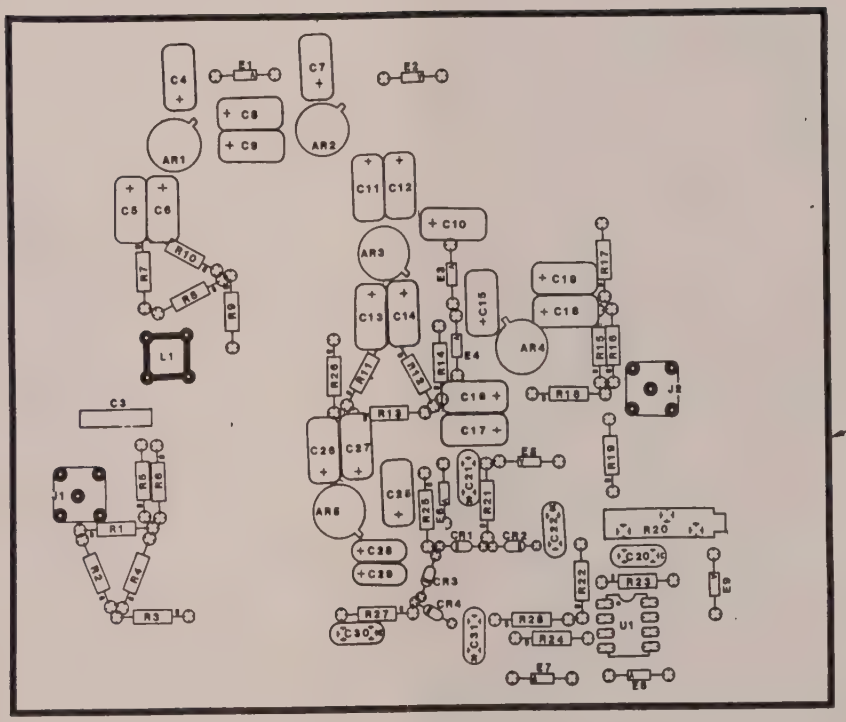


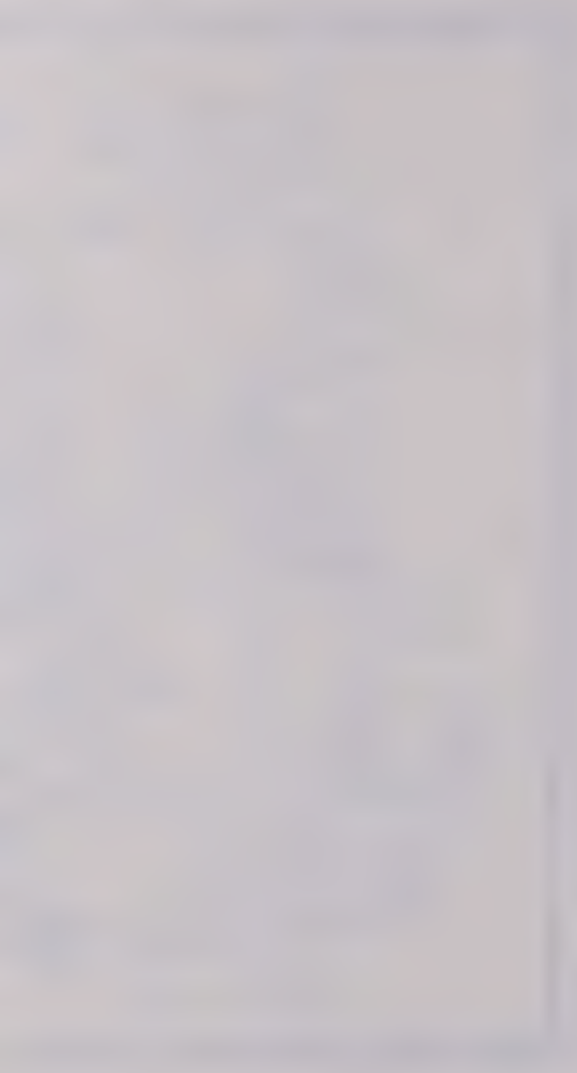
Figure 7-1. Model 921-2
84.903 Mb/s Bit Synchronizer
Signal Conditioner Assembly

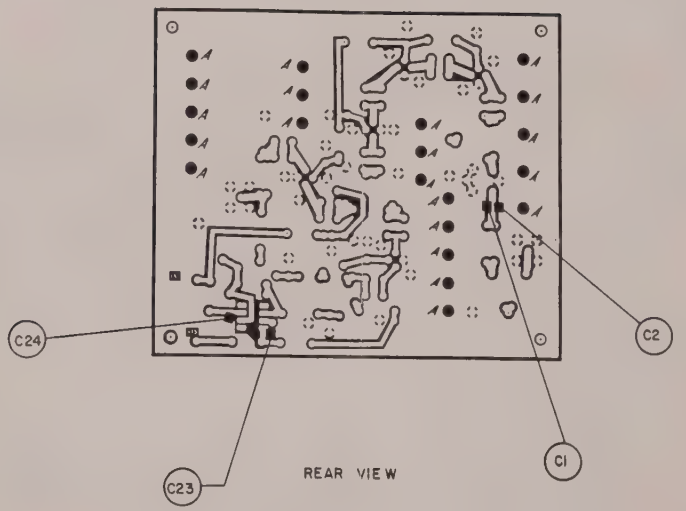


SEE SEPARATE PARTS LIST

196357

Figure 7-2. Signal Conditioner PWB Assembly (A1) (sheet 1 of 2)



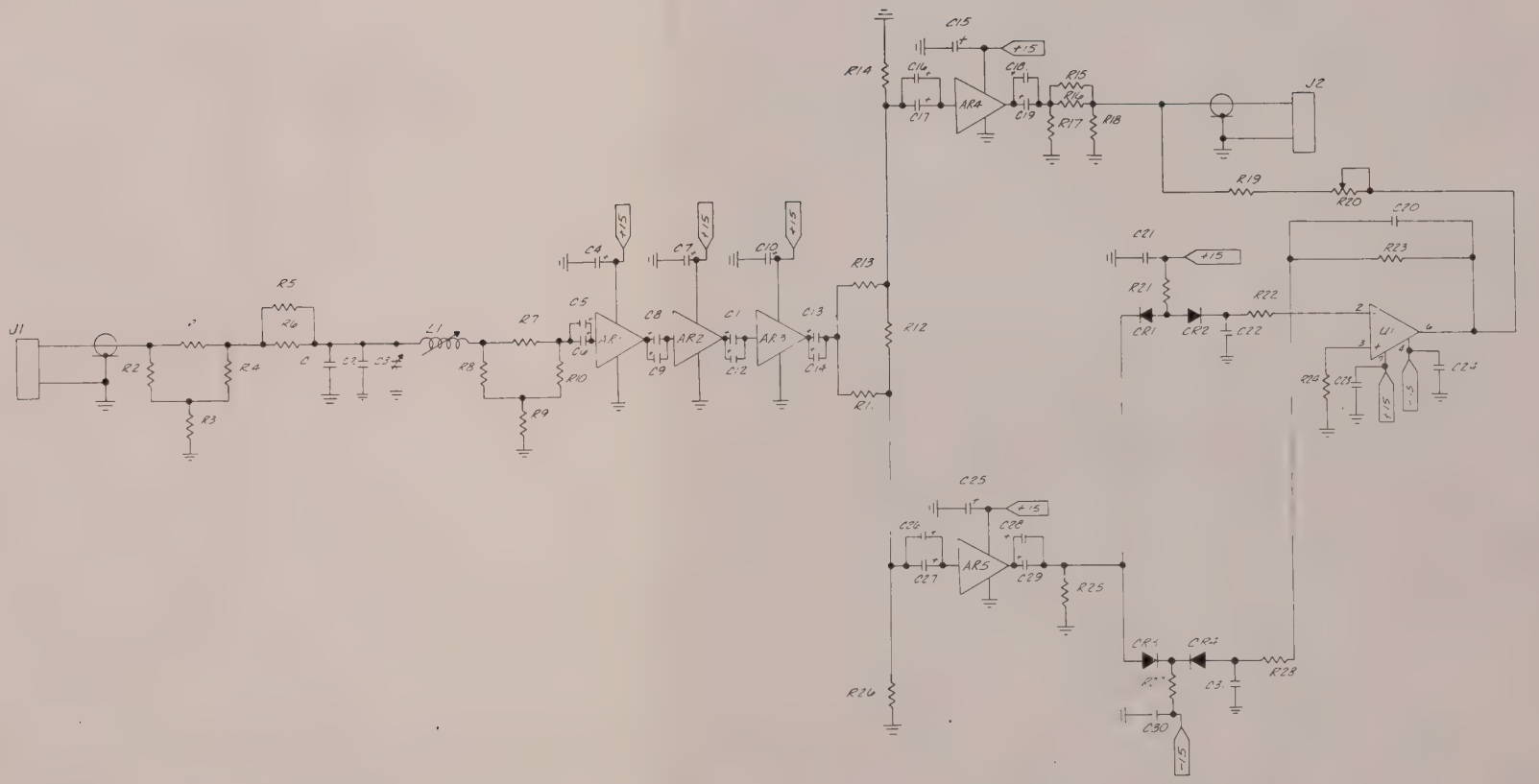


NOTES:

1. ADD "Z" WIRES AT LOCATIONS DESIGNATED "A", USING 20 AWG BUSS WIRE (073317)

196357

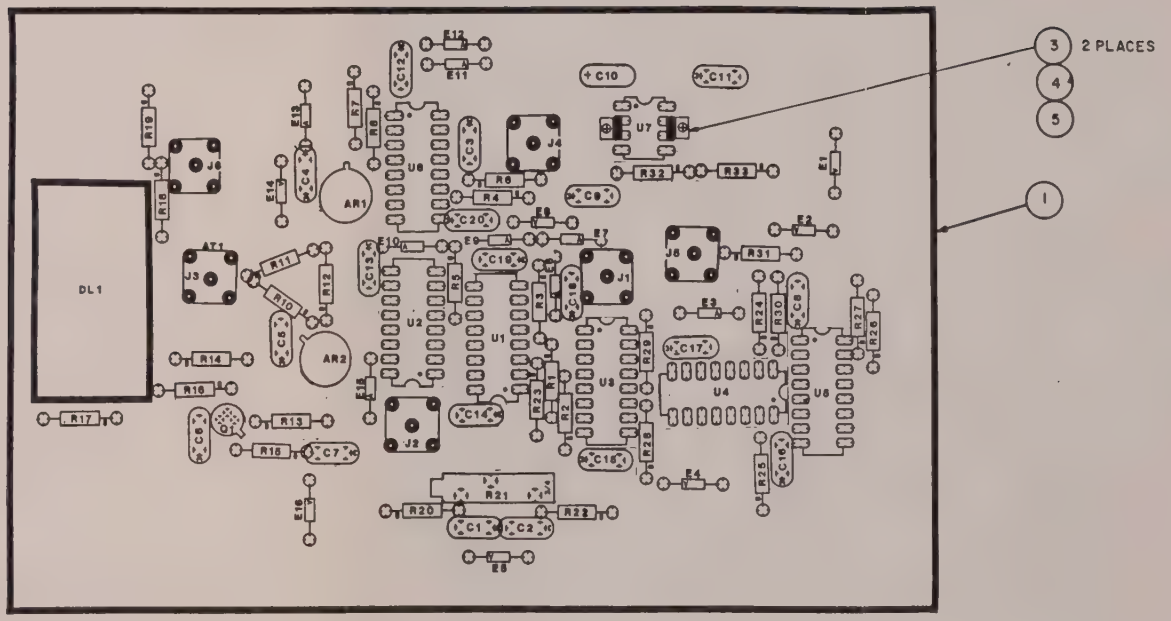
Figure 7-2. Signal Conditioner PWB Assembly (A1) (sheet 2 of 2)



196359

NOTE:
1. CR1 CR2 & CR3 CR4 ARE MATCHED DIODES
2. SEE ASSEMBLY DRAWING FOR LOCATIONS OF E1-9 USED IN POWER FILTERING.

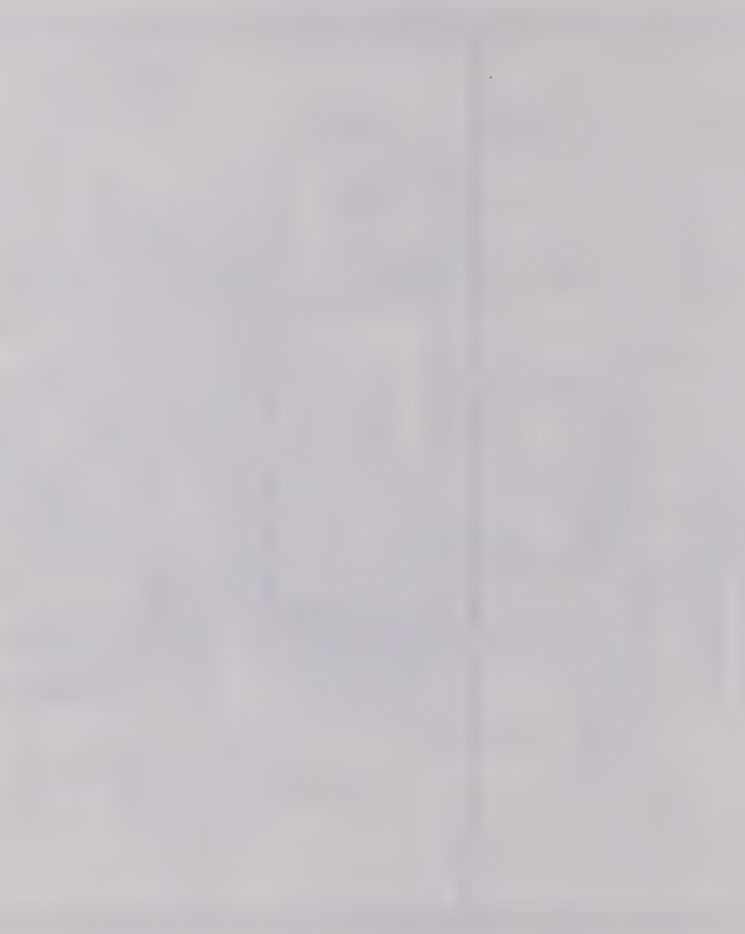
Figure 7-3. Signal Conditioner Schematic Diagram

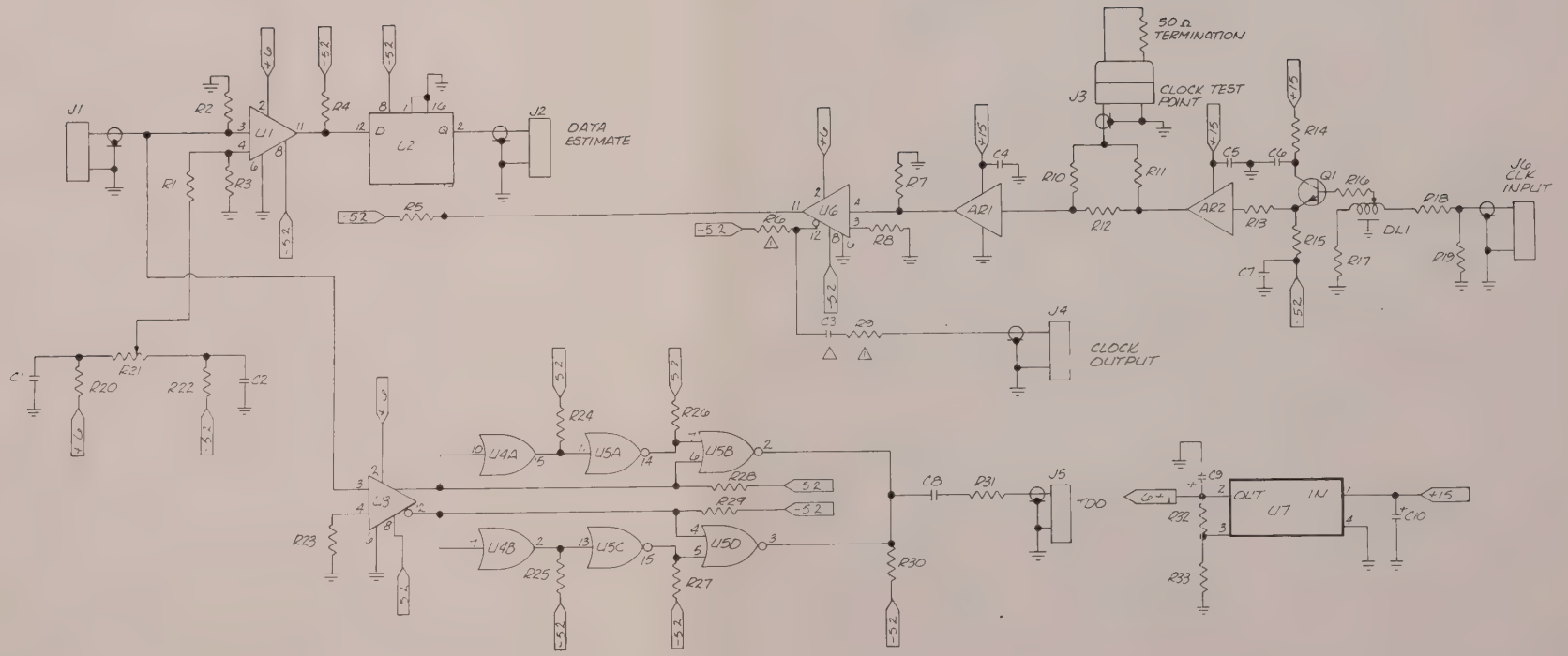


SEE SEPARATE PARTS LIST

196323

Figure - 7-4. Decision Unit-
Transition Detector
PWB Assembly (A2)





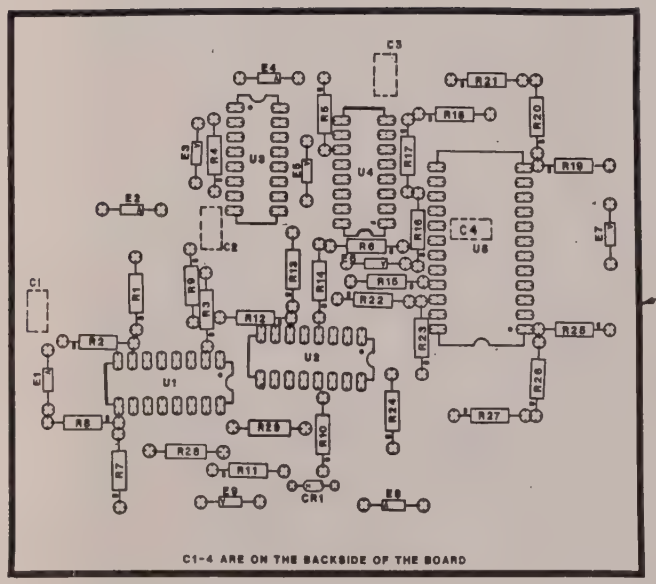
196325

NOTES:

⚠ OMIT WITH OUTPUT BUFFER CARD INSTALL JUMPER WIRE

2. SEE ASSEMBLY DRAWING FOR LOCATIONS OF C11-20, AND E1-E16 USED FOR POWER FILTERING

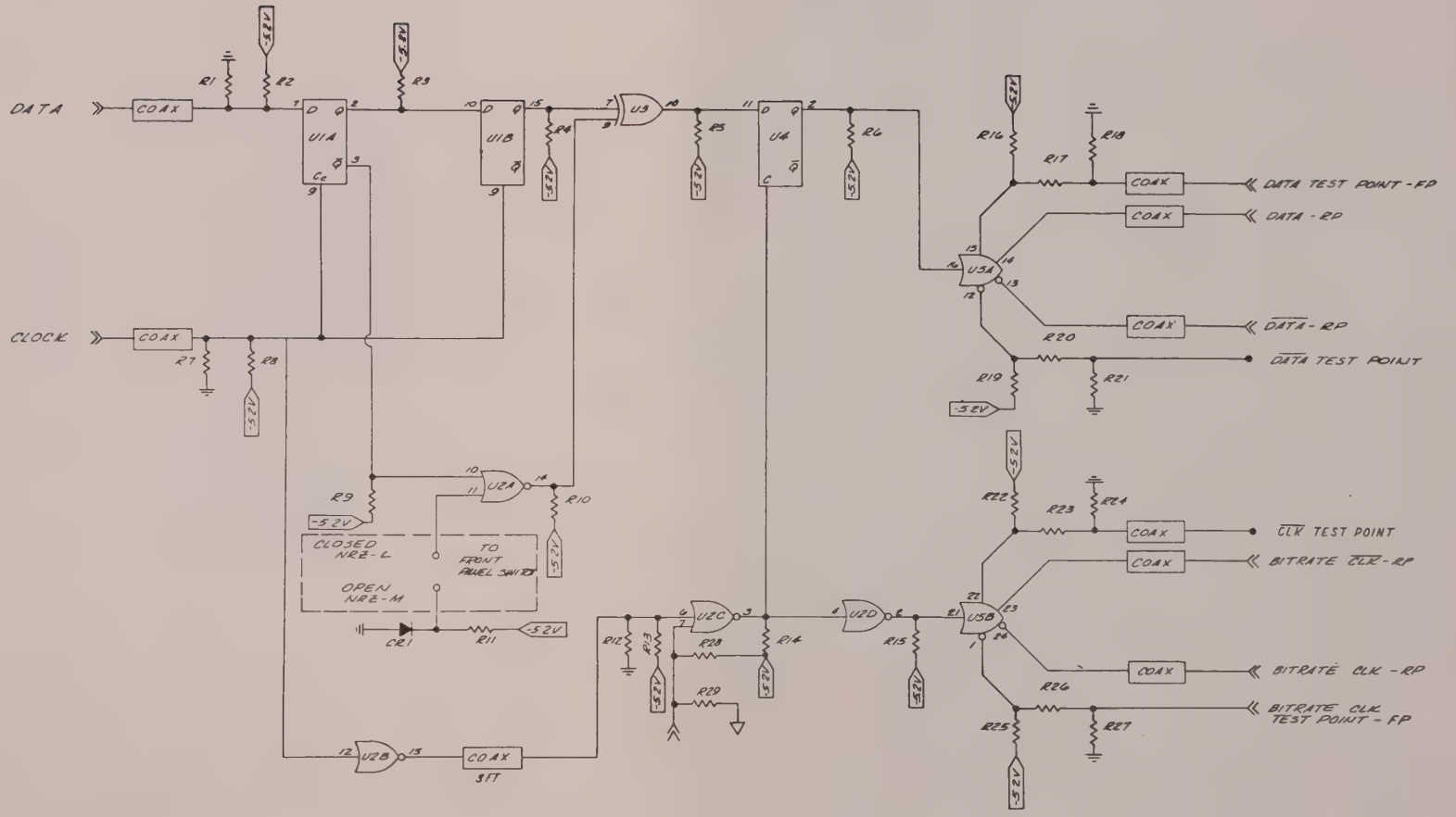
Figure 7-5. Decision Unit-Transition Detector Schematic Diagram



SEE SEPARATE PARTS LIST

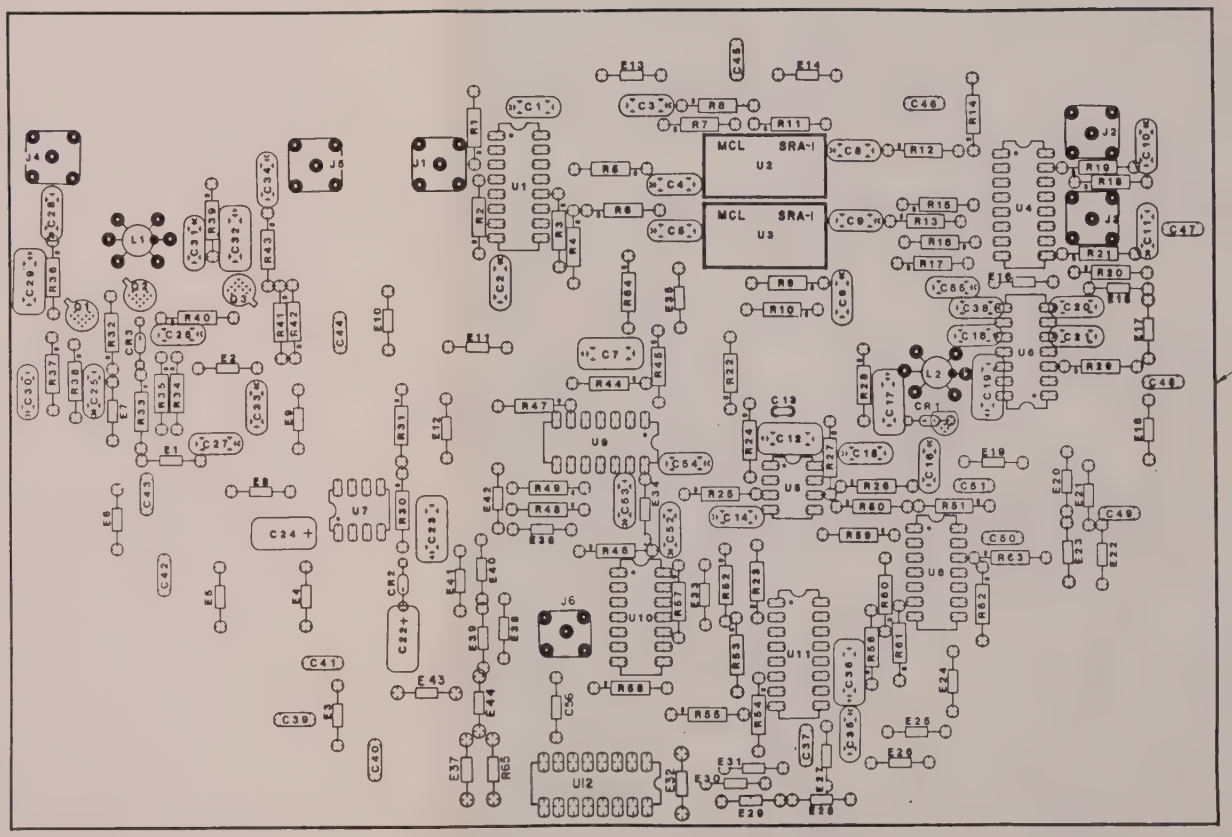
196326

Figure 7-6. PWB Assembly
BSSC Output Circuit



NOTES:
1. SEE ASSEMBLY DRAWING FOR LOCATIONS OF C1-4 AND E1-9 USED FOR POWER FILTERING.

Figure 7-7. BSSC Output Circuit Schematic Diagram



SEE SEPARATE PARTS LISTS

196329

Figure 7-8. PWB Assembly
Tuned Amplifier and
Phaselock Loop

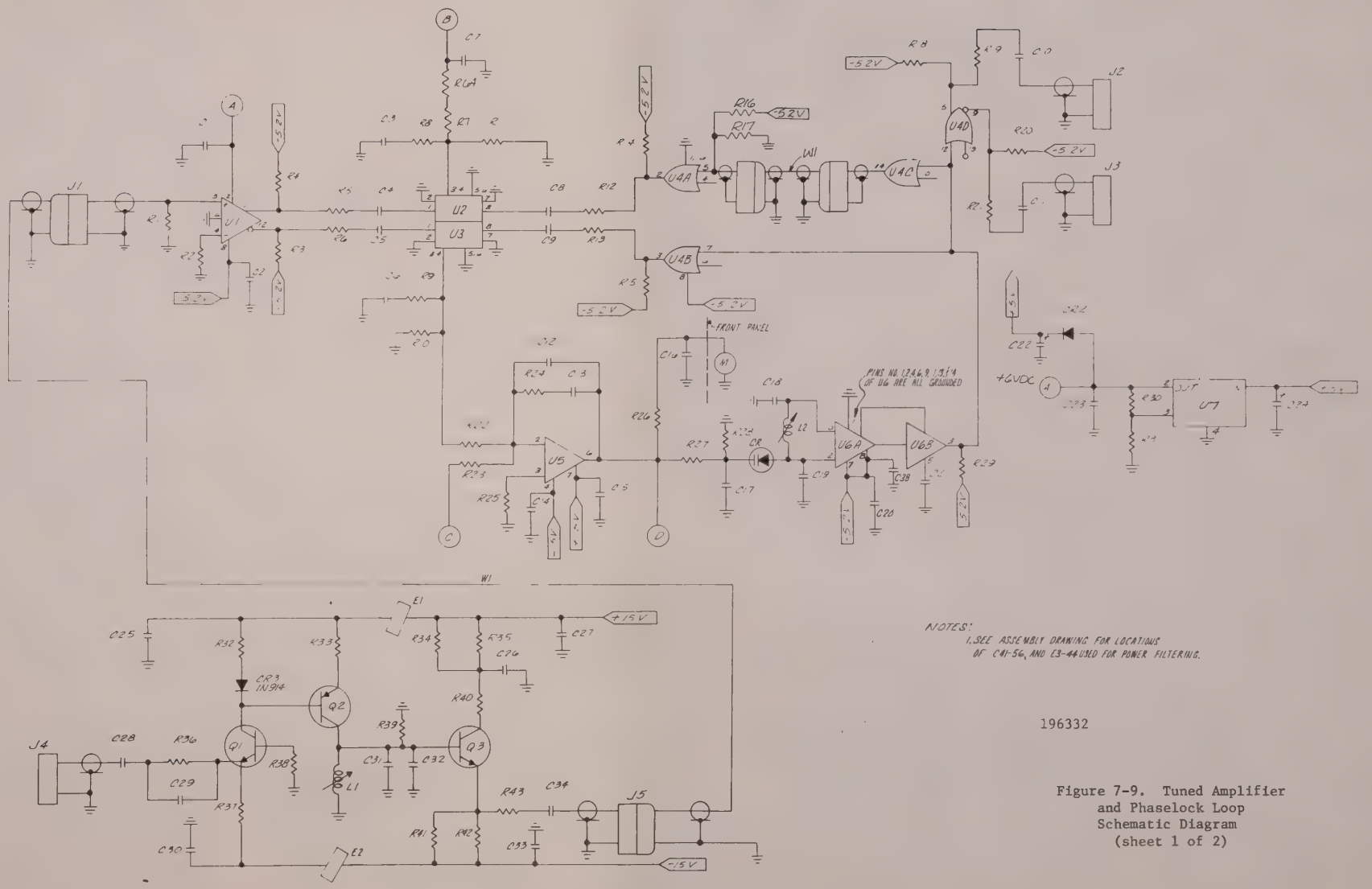


Figure 7-9. Tuned Amplifier and Phaselock Loop Schematic Diagram (sheet 1 of 2)

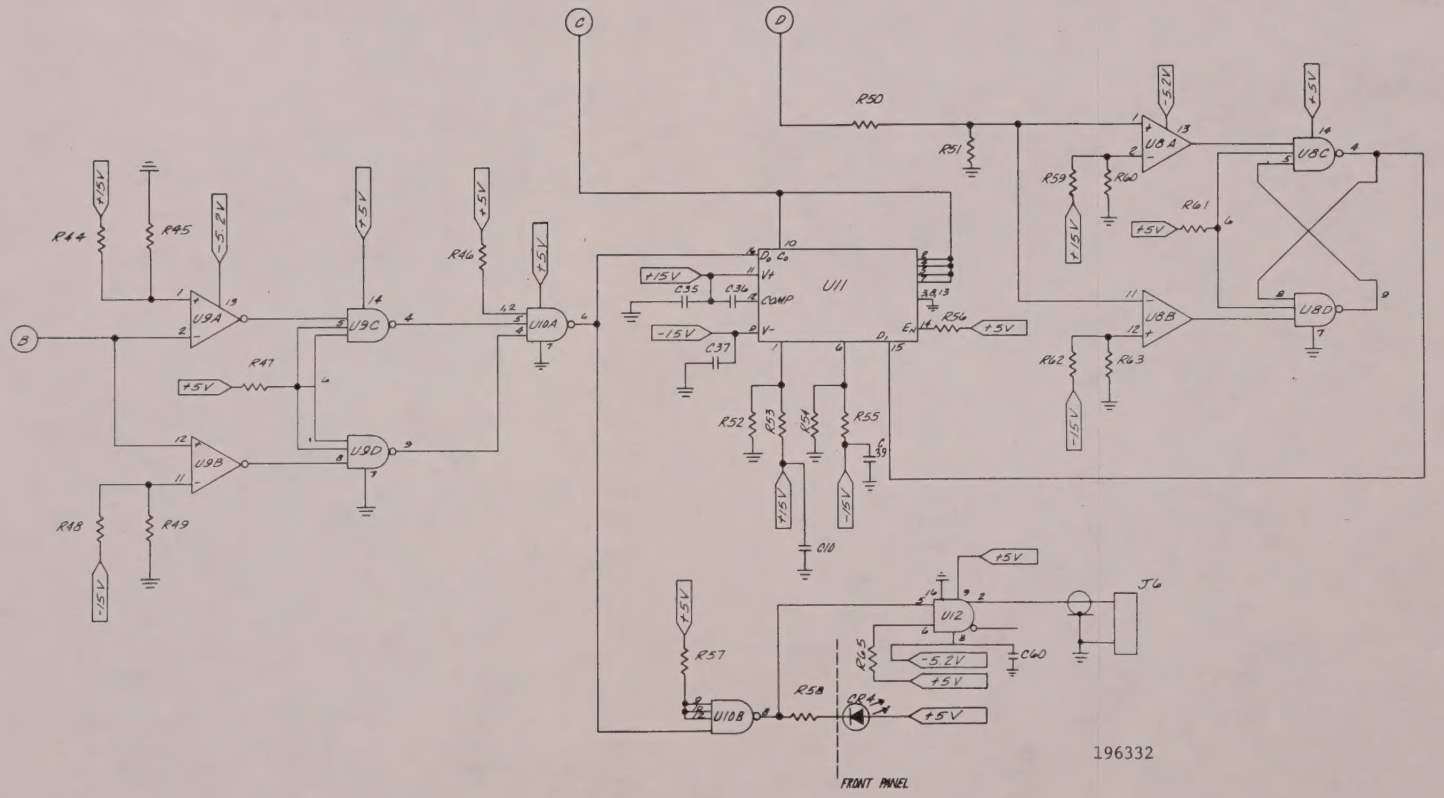
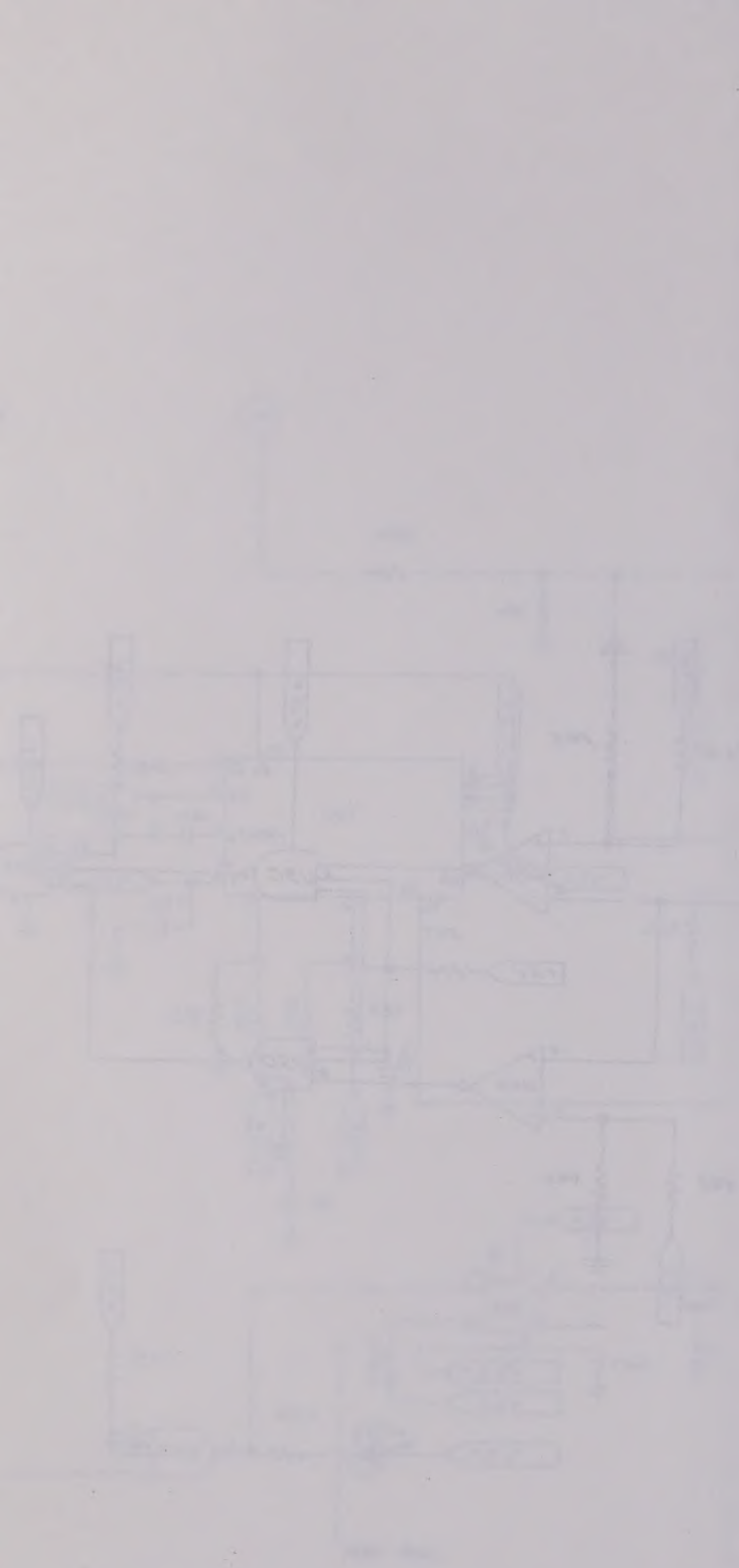


Figure 7-9. Tuned Amplifier and Phaselock Loop Schematic Diagram (sheet 2 of 2)



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